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AMENDMENTS TO THE CLAIMS

- 1. (Original) A peptide selected from the following (a), (b), (c) or (d):
- (a) a peptide consisting of the amino acid sequence as shown in SEQ ID NO: 4;
- (b) a peptide which consists of the amino acid sequence as shown in SEQ ID NO: 4 having addition, deletion or substitution of one or a plurality of amino acids and has β -ionone ring-2-hydroxylase activity;
- (c) a peptide which consists of an amino acid sequence having a 50% or more identity with the amino acid sequence as shown in SEQ ID NO: 4 and has β -ionone ring-2-hydroxylase activity; or
- (d) a bacterium-derived peptide which is encoded by a DNA consisting of the nucleotide sequence as shown in SEQ ID NO: 3 or a DNA hybridizable to a complementary DNA to said DNA under stringent conditions and has β -ionone ring-2-hydroxylase activity.
- 2. (Original) A gene encoding a peptide selected from the following (a), (b), (c) or (d):
- (a) a peptide consisting of the amino acid sequence as shown in SEQ ID NO: 4;
- (b) a peptide which consists of the amino acid sequence as shown in SEQ ID NO: 4 having addition, deletion or substitution of one or a plurality of amino acids and has β -ionone ring-2-hydroxylase activity;
- (c) a peptide which consists of an amino acid sequence having a 50% or more identity with the amino acid sequence as shown in SEQ ID NO: 4 and has β -ionone ring-2-hydroxylase activity; or

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(d) a bacterium-derived peptide which is encoded by a DNA consisting of the nucleotide sequence as shown in SEQ ID NO: 3 or a DNA hybridizable to a complementary DNA to said DNA under stringent conditions and has β -ionone ring-2-hydroxylase activity.

- 3. (Original) A microorganism obtainable by introducing the gene according to claim 2 thereinto, wherein the microorganism is capable of introducing a hydroxyl group at the position 2 carbon of β -ionone ring.
- 4. (Original) A microorganism obtainable by introducing the gene according to claim 2 and other carotenoid biosynthesis genes thereinto, wherein the microorganism is capable of introducing a hydroxyl group at the position 2 carbon of β -ionone ring.
- 5. (Original) The microorganism according to claim 4, wherein the other carotenoid biosynthesis genes are all or a part of a gene cluster required for synthesizing β -ionone ring-containing carotenoids from farnesyl pyrophosphate.
- 6. (Currently amended) The microorganism according to any one of claims 3 to 5 claim 3, wherein the microorganism is *Escherichia coli*.
- 7. (Currently amended) A method of preparing a hydroxylated carotenoid, comprising culturing the microorganism according to any one of claims 3 to 6 claim 3 in a medium and obtaining from

the resultant culture or cells a carotenoid which is hydroxylated at the position 2 carbon of its β ionone ring.

- 8. (Original) The method according to claim 7, wherein the carotenoid which is hydroxylated at the position 2 carbon of its β -ionone ring is β , β -carotene-2-ol (2-hydroxy- β -carotene), β , β -carotene-2,2'-diol (2,2'-dihydroxy- β -carotene), caloxanthin (2-hydroxyzeaxanthin), nostoxanthin (2,2'-dihydroxyzeaxanthin), 2-hydroxy- β , β -carotene-4,4'-dione (2,2'-dihydroxycanthaxanthin), 2-hydroxyastaxanthin or 2,3,2',3'-tetrahydroxy- β , β -carotene-4,4'-dione (2,2'-dihydroxyastaxanthin).
- 9. (Original) 2,2'-dihydroxy-β,β-carotene-4,4'-dione (2,2'-dihydroxycanthaxanthin) represented by the following chemical formula (I):

10. (Original) An antioxidant comprising 2,2'-dihydroxy- β , β -carotene-4,4'-dione (2,2'-dihydroxycanthaxanthin) or 2-hydroxy- β , β -carotene-4,4'-dione (2-hydroxycanthaxanthin) as an active ingredient.

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11. (Original) A gene encoding a peptide selected from the following (e), (f) or (g):

- (e) a peptide consisting of the amino acid sequence as shown in SEQ ID NO: 30;
- (f) a peptide which consists of the amino acid sequence as shown in SEQ ID NO: 30 having addition, deletion or substitution of one or a plurality of amino acids and has β -ionone ring-3-hydroxylase activity; or
- (g) a bacterium-derived peptide which is encoded by a DNA consisting of the nucleotide sequence as shown in SEQ ID NO: 29 or a DNA hybridizable to a complementary DNA to said DNA under stringent conditions and has β -ionone ring-3-hydroxylase activity.
- 12. (Original) A microorganism obtainable by introducing the gene according to claim 11 thereinto, wherein the microorganism is capable of introducing a hydroxyl group at the position 3 carbon of β -ionone ring.
- 13. (Original) A microorganism obtainable by introducing the gene according to claim 11 and other carotenoid biosynthesis genes thereinto, wherein the microorganism is capable of introducing a hydroxyl group at the position 3 carbon of β -ionone ring.
- 14. (Original) The microorganism according to claim 13, wherein the other carotenoid biosynthesis genes are all or a part of a gene cluster required for synthesizing β -ionone ring-containing carotenoids from farnesyl pyrophosphate.

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15. (Currently amended) The microorganism according to any one of claims 12 to 14 claim 12, wherein the microorganism is *Escherichia coli*.

- 16. (Currently amended) A method of preparing a hydroxylated carotenoid, comprising culturing the microorganism according to any one of claims 12 to 15 claim 12 in a medium and obtaining from the resultant culture or cells a carotenoid which is hydroxylated at the position 3 carbon of its β -ionone ring.
- 17. (Original) A gene encoding a peptide selected from the following (h), (i) or (j):
- (h) a peptide consisting of the amino acid sequence as shown in SEQ ID NO: 32;
- (i) a peptide which consists of the amino acid sequence as shown in SEQ ID NO: 32 having addition, deletion or substitution of one or a plurality of amino acids and has geranylgeranyl pyrophosphate synthase activity; or
- (j) a bacterium-derived peptide which is encoded by a DNA consisting of the nucleotide sequence as shown in SEQ ID NO: 31 or a DNA hybridizable to a complementary DNA to said DNA under stringent conditions and has geranylgeranyl pyrophosphate synthase activity.

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